

Spatio-temporal dynamics of submarine groundwater discharge (SGD) on an intertidal beach scale, temperate coastal area

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Submarine groundwater discharge (SGD) is defined as subsurface water flow from the seabed to the coastal sea and ocean. Because groundwater often contains higher nutrients than river water, SGD delivers comparatively large quantities of nutrients to coastal ecosystems. However, there are few studies to examine the detailed dynamics of SGD including spatial heterogeneity, seasonal variation and tide-induced variation. In the present research, we aimed to examine the spatio-temporal dynamics of SGD on an intertidal beach scale in a temperate coastal island.

The study area is located on Ikuchijima Island in Seto Inland Sea, southern Japan. The regional climate is mild, with an annual mean precipitation of 1,100 mm and temperature of 15.6 °C. The whole island is characterized by steep slopes and is widely covered by citrus farms with more than 40% of the island. The previous researches confirmed that SGD can rival or even exceed surface runoff in this island. The target beach is located in the southern area of the island characterized by steep backland topography. Main bottom material of the beach is sand, however, the western part is covered by coarse gravels. We installed piezometers and measured water pressure, water temperature (WT), electric conductivity (EC), and radon (²²²Rn) concentration in pore water on several times from 2018 to 2019. Time-series variation in WT and ²²²Rn in seawater were monitored in December 2019. Before the field campaign in July 2018, the study area had an extreme rainfall event. Large spatial variation in hydraulic potential, water temperature, EC and ²²²Rn concentration in pore water were confirmed in the beach. Significant low EC and high ²²²Rn concentration were confirmed in the western part of the beach.

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